IxDC Reference Library
~~Facts~~)
Surveys (FIC in PNW)
SPR 144

# FOREST INSECT CONDITIONS

## in the Pacific Northwest during 1958

by
W. J. BUCKHORN
and
P. W. ORR

PACIFIC NORTHWEST
FOREST AND RANGE EXPERIMENT STATION
U.S. DEPT OF AGRICULTURE · FOREST SERVICE

MAY 1959

T. M. FILE COPY
REFERENCE LIBRARY

This is the 11th in a series of annual reports of forest insect conditions in Oregon and most of Washington, as revealed by cooperative surveys. These surveys were made by many persons, all of whose efforts were helpful and much appreciated. Special acknowledgment is made to the principal cooperators: Oregon State Board of Forestry, Washington State Department of Natural Resources, and Weyerhaeuser Timber Co. Other cooperators are listed in the appendix. (Note: A part of northeastern Washington is not included in this report. Conditions in Lincoln, Pend Oreille, Spokane, Whitman, and parts of Ferry and Stevens Counties are surveyed and reported by the Missoula, Mont., Forest Insect Laboratory, a unit of the Intermountain Forest and Range Experiment Station, Ogden, Utah.)

COVER BACKGROUND: Egg galleries and larval mines of the silver fir beetle, Pseudohylesinus grandis Sw.

# FOREST INSECT CONDITIONS IN THE PACIFIC NORTHWEST DURING 1958

by

W. J. Buckhorn and P. W. Orr

Division of Forest Insect Research

May 1959

PACIFIC NORTHWEST
FOREST AND RANGE EXPERIMENT STATION
R. W. Cowlin, Director Portland, Oregon

FOREST SERVICE U.S. DEPARTMENT OF AGRICULTURE

CONTENTS


| | Page |
|---|---|
| SURVEY FINDINGS IN BRIEF | 1 |
| PRINCIPAL INSECTS | 4 |
| Defoliators | 4 |
| Spruce Budworm | 4 |
| Larch Bud Moth | 8 |
| Spruce Bud Moth | 8 |
| Black-Headed Budworm | 10 |
| Pandora Moth | 10 |
| Lodgepole Pine Sawfly | 11 |
| Ponderosa Pine Needle Miner | 11 |
| Sucking Insects | 11 |
| Balsam Woolly Aphid | 11 |
| Pine Needle Scale | 13 |
| Bark Beetles | 14 |
| Douglas-Fir Beetle | 14 |
| Mountain Pine Beetle | 16 |
| Western Pine Beetle | 18 |
| Engelmann Spruce Beetle | 19 |
| Fir Engraver | 19 |
| Oregon Pine Ips | 20 |
| Silver Fir Beetles | 21 |
| OTHER INSECTS | 22 |
| Defoliators | 23 |
| Weevils | 24 |
| Aphids | 25 |
| Seed and Cone Insects | 25 |
| Range Insects | 25 |
| OTHER FOREST PEST PROBLEMS | 26 |
| Dying Hemlock | 26 |
| Bear Damage | 26 |

Page

APPENDIX . . . . . 27
Organization and Conduct of Surveys . . . . . 27
Aerial Surveys. . . . . 27
Ground Surveys . . . . . 28
Table 17. Extent of epidemic infestations in Oregon in 1958, by forest area, insect species, and intensity of infestation . . . . . 30
Table 18. Extent of epidemic infestations in Washington in 1958, by forest area, insect species, and intensity of infestation . . . . . 36
Figure 2. Spruce budworm situation in Oregon and Washington, 1958 . . . . . .
Figure 3. Generalized areas of forest insect epidemics, other than spruce budworm, in Oregon and Washington, 1958 . . . . . .

## SURVEY FINDINGS IN BRIEF

In general, 1958 was a better-than-average year for the forest manager in his efforts to hold insects in check in the Pacific Northwest. Outbreaks totaled slightly more than 2 million acres (table 1). The extent and intensity of outbreaks by insect species are given in detail in table 17 for Oregon and in table 18 for Washington. Locations of the most important outbreaks are shown in figures 2 and 3. (Tables 17 and 18 and figures 2 and 3 are located in the appendix.)

Principal findings of the 1958 survey were as follows:

1. The spruce budworm, balsam woolly aphid, Douglas-fir beetle, mountain pine beetle, and western pine beetle accounted for most of the epidemic acreage.

2. Outbreaks of the following insects increased:

   a. Douglas-fir beetle.--Tree killing from attacks in 1957 and 1958 was severe in southern Oregon. Attacks in 1959 are expected to decline.

   b. Mountain pine beetle.--The extent of infestations increased in western white pine, ponderosa pine, and sugar pine, but decreased in lodgepole pine.

   c. Western pine beetle.--Tree killing increased generally in both States, becoming moderately to heavily epidemic in a few places.

   d. Silver fir beetles.--Tree killing in this infestation, rated light epidemic, increased in northern Washington.

   e. Fir engraver.--Losses were principally in subalpine stands and about equally distributed between the two States.

Table 1.--Summary of 1958 forest insect epidemic infestations in Oregon and Washington

| Insects[1] | Oregon | | Washington[2] | | Regional total | |
|---|---|---|---|---|---|---|
| | Infestation centers | Area | Infestation centers | Area | Infestation centers | Area |
| | Number | Acres | Number | Acres | Number | Acres |
| Defoliators: | | | | | | |
| Spruce budworm | 84 | 315,440 | 0 | 0 | 84 | 315,440 |
| Larch bud moth | 0 | 0 | 45 | 41,920 | 45 | 41,920 |
| Spruce bud moth | 14 | 4,800 | 1 | 480 | 15 | 5,280 |
| Black-headed budworm | 0 | 0 | 9 | 2,720 | 9 | 2,720 |
| Pandora moth | 1 | 1,600 | 0 | 0 | 1 | 1,600 |
| Lodgepole pine sawfly | 1 | 320 | 0 | 0 | 1 | 320 |
| Ponderosa pine needle miner | 1 | 160 | 0 | 0 | 1 | 160 |
| All defoliators | 101 | 322,320 | 55 | 45,120 | 156 | 367,440 |
| Sucking insects: | | | | | | |
| Balsam woolly aphid | 111 | 110,560 | 75 | 145,760 | 186 | 256,320 |
| Pine needle scale | 0 | 0 | 7 | 10,400 | 7 | 10,400 |
| All sucking insects | 111 | 110,560 | 82 | 156,160 | 193 | 266,720 |
| Bark beetles: | | | | | | |
| Douglas-fir beetle | 672 | 880,160 | 118 | 51,320 | 790 | 931,480 |
| Mountain pine beetle (W) | 67 | 32,160 | 486 | 190,880 | 553 | 223,040 |
| Mountain pine beetle (L) | 58 | 36,640 | 11 | 5,920 | 69 | 42,560 |
| Mountain pine beetle (P) | 4 | 2,560 | 0 | 0 | 4 | 2,560 |
| Western pine beetle | 78 | 96,640 | 91 | 56,080 | 169 | 152,720 |
| Engelmann spruce beetle | 9 | 4,640 | 14 | 3,840 | 23 | 8,480 |
| Fir engraver | 35 | 11,120 | 46 | 10,880 | 81 | 22,000 |
| Oregon pine ips | 43 | 7,680 | 16 | 3,320 | 59 | 11,000 |
| Silver fir beetles | 0 | 0 | 25 | 4,720 | 25 | 4,720 |
| All bark beetles | 966 | 1,071,600 | 807 | 326,960 | 1,773 | 1,398,560 |
| All insects | 1,178 | 1,504,480 | 944 | 528,240 | 2,122 | 2,032,720 |

1/ Mountain pine beetle infestations are separated by tree species: L, lodgepole pine; P, ponderosa pine; W, western white pine.

2/ Except Lincoln, Pend Oreille, Spokane, Whitman, and parts of Ferry and Stevens Counties.

f. Larch bud moth. --Defoliation of western larch in the Cascade Range of Washington increased somewhat.

g. Pine needle scale. --On ponderosa pine adjacent to orchards near Wenatchee, Wash., damage was more conspicuous.

3. Outbreaks of the following insects decreased:

a. Spruce budworm. --The epidemic infestations were the lowest they had been during the period of detailed records, beginning in 1947.

b. Balsam woolly aphid. --Killing by the aphid decreased for the first year since discovery of the outbreak in 1954, but a population increase late in the season indicated that losses of timber were likely to rise again soon.

c. Spruce bud moth. --The outbreak of 1957 in coastal forests subsided without causing appreciable damage.

d. Black-headed budworm. --The extensive outbreak that flared up suddenly in 1957 in the Cascade Range of Washington practically disappeared.

e. Oregon pine ips. --Damage by this insect was the least in many years.

f. Engelmann spruce beetle. --Losses decreased considerably and totaled about the same acreage in both States.

4. New outbreaks of the following insects were found:

a. Pandora moth. --A flareup of subepidemic intensity developed on ponderosa pine on the Deschutes National Forest in Oregon--the first recorded outbreak in many years.

b. Lodgepole pine sawfly. --A small infestation appeared in an isolated stand of lodgepole pine on the Willamette National Forest in Oregon.

c. Ponderosa pine needle miner.--Considerable feeding on ponderosa pine on the Fremont National Forest in Oregon was noted early in the season but the damage became inconspicuous later.

d. Other insects noted in abnormal numbers were sawflies on Douglas-fir, noble fir, and other true firs; a weevil on noble fir; and several seed and cone insects.

## PRINCIPAL INSECTS

The outbreaks reported in this section are of present or potential economic importance. In general, they caused damage conspicuous and extensive enough to be observed and mapped from the air.

### Defoliators

#### SPRUCE BUDWORM
#### Choristoneura fumiferana (Clem.)

The epidemic outbreaks that began in 1944 are still in progress, but are less extensive than at any time since 1947, when detailed records were begun (fig. 1).

In 1958, spraying covered 818,000 acres of threatening epidemic infestations, bringing the total area sprayed since 1949 to 4,658,000 acres. Average mortality in 1958 was 96.2 percent, achieved at a cost of $0.69 per acre.

The regional survey revealed residual populations on the Ochoco, Malheur, and Wallowa-Whitman National Forests in the Blue Mountains of Oregon. Four new, light epidemic centers appeared in unsprayed areas of eastern Oregon. One was on the Deschutes National Forest in the Fly Creek drainage; the other three were on the Fremont National Forest in the Dairy Creek and Kelly Creek drainages and on the east slopes of Rogger Peak (table 2).

Defoliation by the 1957-58 brood increased in extent and severity on the Snake, Joseph, and Pine Creek units of the Wallowa-Whitman National Forests. Elsewhere, practically all defoliation was of light intensity.

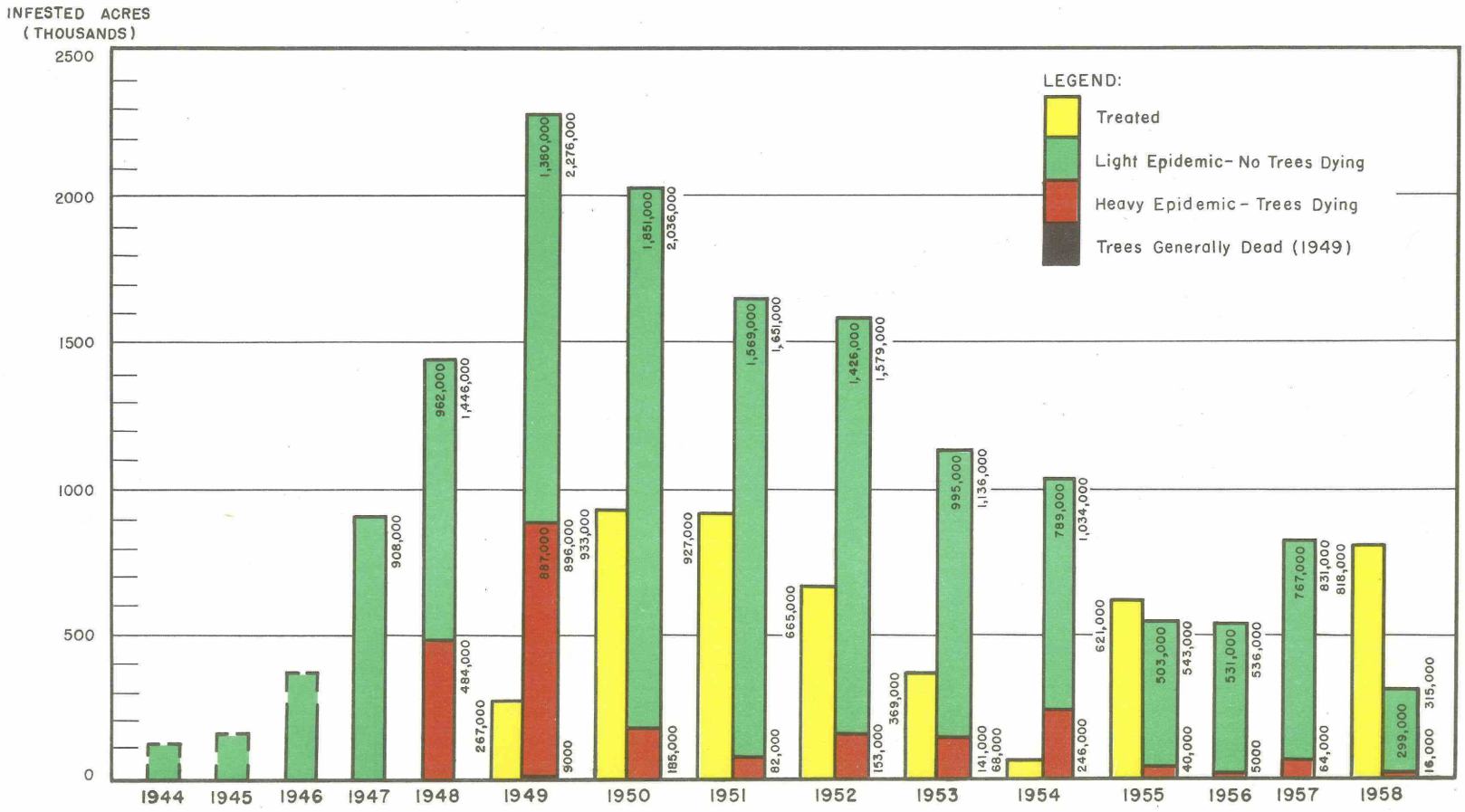



Figure 1.--Progress of the spruce budworm epidemic in Oregon and Washington, 1944-58.

ACF 555-PORTLAND,ORE

Table 2.--Extent of spruce budworm infestations in Oregon in 1958, by control unit and intensity of infestation

(In acres)

| Administrative area[1] and control unit | Intensity of infestation | | | All intensities |
|---|---|---|---|---|
| | Light | Moderate | Heavy | |
| Ochoco N.F.: | | | | |
| Snow Mountain | 6,400 | 0 | 0 | 6,400 |
| Malheur N.F.: | | | | |
| Aldrich Mountain | 1,280 | 640 | 0 | 1,920 |
| West Myrtle Butte | 2,600 | 0 | 0 | 2,600 |
| King Mountain | 8,960 | 0 | 0 | 8,960 |
| Wolf Mountain | 4,960 | 0 | 0 | 4,960 |
| Frazier Point | 4,000 | 0 | 0 | 4,000 |
| Antelope Mountain | 3,320 | 0 | 0 | 3,320 |
| Total | 25,120 | 640 | 0 | 25,760 |
| Wallowa-Whitman N.F.: | | | | |
| Silver Butte–Umatilla | 4,000 | 0 | 0 | 4,000 |
| Bald Ridge | 3,680 | 0 | 0 | 3,680 |
| Joseph | 32,480 | 34,240 | 1,600 | 68,320 |
| Snake | 76,160 | 23,360 | 12,800 | 112,320 |
| Moss Spring | 2,320 | 0 | 0 | 2,320 |
| Pine Creek | 48,800 | 960 | 0 | 49,760 |
| Total | 167,440 | 58,560 | 14,400 | 240,400 |
| Lookout Mountain (B.L.M.): | | | | |
| Lookout Mountain | 0 | 0 | 2,000 | 2,000 |
| Deschutes N.F.: | | | | |
| Fly Creek | 2,080 | 0 | 0 | 2,080 |
| Fremont N.F.: | | | | |
| Dairy Creek | 35,440 | 0 | 0 | 35,440 |
| Rogger Peak | 1,600 | 0 | 0 | 1,600 |
| Kelly Creek | 1,760 | 0 | 0 | 1,760 |
| Total | 38,800 | 0 | 0 | 38,800 |
| All units | 239,840 | 59,200 | 16,400 | 315,440 |

[1] N.F., national forest; B.L.M., Bureau of Land Management.

315,440
818 050
1,133,490

In the fall, a special survey was made of the major centers of infestation to determine the status of the budworm populations that will feed in 1959 (table 3). The number of new and old egg masses per 1,000 square inches of foliage was used as a basis for determining population and trend. In general, the budworm population is declining and serious damage is not expected in 1959. At two localities--one on the Fremont and one on the Wallowa-Whitman National Forests--the trend is slightly upward and should be watched carefully in 1959.

No further spraying is planned in the near future since natural forces are effecting satisfactory control.

## LARCH BUD MOTH
Zeiraphera griseana (Hübner)

Western larch was defoliated on extensive areas in Washington, especially on the Okanogan, Wenatchee, and Snoqualmie National Forests and the Yakima and Colville Indian Reservations.

This insect periodically becomes epidemic on larch over large areas. It also attacks Douglas-fir, true firs, and Engelmann spruce. Outbreaks to date have been of short duration. The defoliated trees often put out new needles after the bud moth has completed feeding, and tree killing is generally insignificant, although annual increment may be reduced to some extent by repeated defoliations. Direct control is considered unnecessary.

The present trend is upward. Subepidemic populations on Douglas-fir and white fir in both eastern and western Oregon have continued to be light and are causing no appreciable damage.

## SPRUCE BUD MOTH
Zeiraphera ratzeburgiana Sax.

The extensive outbreaks in Sitka spruce stands along the Oregon and Washington coast declined to a few, small, spot infestations on the Siuslaw National Forest in Oregon and on the Olympic National Forest in Washington. The downward trend is expected to continue in 1959.

Table 3.--Density of 1958 spruce budworm egg populations and population trends at 18 points in Oregon

| Administrative area[1] and sampled locality | Egg masses per 1,000 sq.in. of foliage | | Class of density, 1958 level[2] | Trend |
|---|---|---|---|---|
| | New | Old | | |
| | ------ Number ------ | | | |
| Deschutes N.F.: | | | | |
| Green Ridge | 0.0 | 0.0 | Very low | Down |
| Fremont N.F.: | | | | |
| Picture Flat | .7 | 2.2 | " | " |
| Coleman Ridge | 4.4 | 4.1 | Low | Up |
| Malheur N.F.: | | | | |
| King Mountain, No. 1 | .7 | 3.7 | Very low | Down |
| King Mountain, No. 2 | .4 | .6 | " | " |
| Ochoco N.F.: | | | | |
| Alder Springs | .2 | .9 | " | " |
| Snow Mountain | .1 | 1.2 | " | " |
| Wallowa-Whitman N.F.: | | | | |
| Baker | .3 | 1.0 | " | " |
| Sumpter-Tipton | .1 | 2.3 | " | " |
| Duck Creek, No. 1 | 1.7 | 6.3 | " | " |
| Duck Creek, No. 2 | .3 | 1.6 | " | " |
| Fish Lake, No. 1 | 1.4 | 2.2 | " | " |
| Fish Lake, No. 2 | 1.2 | 1.3 | " | (3/) |
| Joseph-Lick Creek | .7 | 6.1 | " | Down |
| Joseph-Nesbitt Butte | .7 | 3.2 | " | " |
| Joseph-Harl Butte | .6 | 6.9 | " | " |
| Joseph-Gumboot Butte | .8 | 2.2 | " | " |
| Imnaha-Hat Point | 4.2 | 4.6 | Low | (3/) |

1/ N.F., national forest.

2/ Very low, 0.0 to 2.0; low, 2.0 to 4.5; moderate, 4.5 to 9.0.

3/ Uncertain.

## BLACK-HEADED BUDWORM
Acleris variana (Fern.)

The first extensive outbreak of this insect in the Washington Cascades began in 1957 and subsided to a few spot infestations on the Snoqualmie and Gifford Pinchot National Forests in 1958. In this outbreak western hemlock was the preferred host, but true firs and Douglas-fir were also attacked. In eastern Oregon, subepidemic populations of the budworm, too light to be detected from the air, were present on subalpine fir on the Umatilla National Forest and on Engelmann spruce on the Wallowa-Whitman National Forests. Elsewhere, light populations occurred on Douglas-fir and white fir.

In western Washington, research studies showed that egg sterility accounted for a 30-percent reduction of brood. Larval populations were reduced 54 percent by parasites and 32 percent by other causes, chiefly a microsporidian disease.

In eastern Oregon, similar population reductions at spots on the Umatilla National Forest were attributed to insect parasites and disease was not a major control factor in this area. At other points in eastern Oregon, late-season pupal populations indicated that a slight buildup may occur in 1959.

## PANDORA MOTH
Coloradia pandora Blake

A moth flight near Sisters, Oreg., in August provided the first opportunity in about 25 years to study the biology and natural control of this periodic defoliator of ponderosa pine. Eggs were deposited in August and hatched early in September, and the larvae fed gregariously until mid-October. At that time the larvae dispersed and began feeding individually and occasionally in groups of two to four. These immature larvae overwinter on the needles and commence feeding again the next spring. Upon reaching maturity the larvae drop to the ground and pupate for 1 full year.

Damage to foliage was light this year but it is expected to increase as the larvae reach maturity in 1959.

So far the incidence of parasitism has been low. When the larvae drop to the ground to pupate, predation by rodents should

reduce the population considerably. The trend of this light infestation is uncertain at present.

LODGEPOLE PINE SAWFLY
Neodiprion sp.

One small spot of 320 acres of light infestation appeared on the Willamette National Forest in Oregon. Experience shows that even on severely defoliated areas little tree mortality results. The trend is apparently upward, but the host tree--lodgepole pine--is limited in extent in this particular area.

PONDEROSA PINE NEEDLE MINER
Argyresthia sp.

Larvae of this unidentified needle miner killed much of the old foliage of ponderosa pine on 160 acres in the Warner District, Fremont National Forest. Some fear was felt that the trees might be killed, or at least weakened so much they would be prey to bark beetles. However, new needles developed normally, and by the end of the season the trees had recovered with little sign of lasting harmful effects.

## Sucking Insects

BALSAM WOOLLY APHID
Chermes piceae (Ratz.)

The extent and intensity of damage caused by this aphid declined early in the season for the first time since discovery of the outbreak in 1954 (table 4). However, aggressive bole infestations became prevalent on subalpine fir in the Cascade Range in the two States late in the season, indicating that the epidemic may increase in these areas in 1959. Severe mortality of merchantable Pacific silver fir has occurred. Mortality was also severe in subalpine fir stands on recreational and watershed areas.

The bulk of the damage in Oregon occurred in subalpine fir stands on the Willamette and Mount Hood National Forests (table 5). Tree killing also continued in mature Pacific silver fir stands in the

Table 4.--Trend of balsam woolly aphid infestations in Oregon and Washington, 1954-58

(In acres)

| Year of detection | Area of epidemic infestations | | Regional total |
|---|---|---|---|
| | Oregon | Washington[1/] | |
| 1954 | 0 | 129,920 | 129,920 |
| 1955 | 35,680 | 258,880 | 294,560 |
| 1956 | 152,210 | 203,780 | 355,990 |
| 1957 | 385,200 | 214,560 | 599,760 |
| 1958 | 110,560 | 145,760 | 256,320 |

[1/] Except Lincoln, Pend Oreille, Spokane, Whitman, and parts of Ferry and Stevens Counties.

vicinity of Black Rock, Oreg., adjacent to the Siuslaw National Forest. Much of the overstory in this area is dead and understory trees are severely infested.

In Washington, the heaviest damage continued in the Green, Toutle, and Kalama River drainages on the Gifford Pinchot National Forest, but considerable tree recovery was noted in the Lewis River area south of Mount St. Helens. The aphid was detected in the Stevens Canyon area of Mount Rainier National Park, marking the northernmost point it has been found in Washington.

The predicted trend for 1959 is upward in subalpine fir stands and static or slightly downward in Pacific silver fir stands in the region.

Research on the balsam woolly aphid was given high priority in 1958. Six species of insect predators were imported from Europe and Asia and released in the Northwest in a study of the possibilities of biological control. Two species of introduced predators have become at least temporarily established. Also, a number of native predators have been found. Most of these vary in abundance from area to area and from tree to tree; they appear to be most effective when the aphid population is high.

Table 5.--Extent of balsam woolly aphid infestations in 1958, by administrative area and intensity of infestation

| Administrative area[1/] [2/] | Infestation centers | Intensity of infestation | | | | All intensities |
|---|---|---|---|---|---|---|
| | | Light | Moderate | Heavy | Very Heavy | |
| | Number | Acres | | | | |
| Oregon: | | | | | | |
| Willamette N.F. | 41 | 42,880 | 12,640 | 0 | 0 | 55,520 |
| Mt. Hood N.F. | 59 | 20,800 | 8,800 | 0 | 0 | 29,600 |
| Siuslaw N.F. | 1 | 7,520 | 10,560 | 480 | 0 | 18,560 |
| Warm Springs I.R. | 5 | 2,080 | 480 | 0 | 0 | 2,560 |
| Umpqua N.F. | 2 | 2,240 | 0 | 0 | 0 | 2,240 |
| Deschutes N.F. | 4 | 2,080 | 0 | 0 | 0 | 2,080 |
| Oregon areas | 112 | 77,600 | 32,480 | 480 | 0 | 110,560 |
| Washington: | | | | | | |
| Gifford Pinchot N.F. | 56 | 72,290 | 34,010 | 15,140 | 4,960 | 126,400 |
| SW. Washington (W.S.D.N.R.) | 10 | 12,480 | 320 | 0 | 0 | 12,800 |
| Snoqualmie N.F. | 8 | 6,080 | 0 | 0 | 0 | 6,080 |
| Wenatchee N.F. | 1 | 480 | 0 | 0 | 0 | 480 |
| Washington areas | 75 | 91,330 | 34,330 | 15,140 | 4,960 | 145,760 |
| All areas | 187 | 168,930 | 66,810 | 15,620 | 4,960 | 256,320 |

[1/] Areas include damage on lands of all ownerships.

[2/] N.F., national forest; I.R., Indian reservation; W.S.D.N.R., Washington State Department of Natural Resources.

## PINE NEEDLE SCALE
## *Phenacaspis pinifoliae* (Fitch)

Infestations spread and became more numerous than usual on ponderosa pine in the vicinity of Leavenworth and Ardenvoir on the Wenatchee National Forest. These infestations have been observed for several years and have been attributed to reduction of natural predators caused by spray drift from surrounding orchards. Other light outbreaks appeared on ponderosa pine on the Colville Indian Reservation, Warm Springs Indian Reservation, and Rogue River National Forest. Minor infestations on lodgepole pine were recorded on the Deschutes National Forest in the vicinity of

Pringle Falls. In these areas, damage is more prevalent along dusty roads and immediately adjacent to mixing plants for road asphalt. The outbreaks appear to be increasing regionwide.

## Bark Beetles

### DOUGLAS-FIR BEETLE
*Dendroctonus pseudotsugae* Hopk.

The Douglas-fir beetle was epidemic in in two areas: one, in southwestern Oregon; the other, in north-central Washington (table 6). Elsewhere in the region, there was a general increase in the number of individual trees and small groups attacked by the beetle.

Epidemic outbreaks occurred from Lincoln County, Oreg., south into northern California, with the most severe centers located in the Umpqua River drainage and adjacent stands on the Rogue River National Forest. Considerable tree killing also occurred on the Siskiyou and Siuslaw National Forests.

The north-central Washington centers of infestation were smaller, but the beetles were aggressive. Small outbreaks of light and moderate intensity were present in the Twisp and Methow River drainages on the Okanogan National Forest. On the Colville Indian Reservation, infestations ranging from light to heavy in intensity appeared once again in the Nine Mile Creek and Gold Creek drainages.

The current epidemic in southwestern Oregon resulted from beetle populations that bred in trees that were windthrown in the winter of 1955-56. These trees were attacked in the spring of 1956 and produced broods that emerged in the spring of 1957. The new adults attacked surrounding green trees, causing extensive fading that year and early in the spring of 1958.

In southwestern Oregon a special assessment survey was made in 1958 to determine the status of populations and the probable trend for 1959. A total of 101 groups of trees recently beetle killed were examined and the ratio of 1958 to 1957 mortality was obtained to determine the trend of the outbreak. Also, 9.2 miles of cruise line, one-half chain wide, was run through all intensities of damage to obtain similar data. There was a significant increase in 1958

Table 6.--Extent of Douglas-fir beetle infestations in 1958, by administrative area and intensity of infestation

| Administrative area[1/ 2/] | Infestation centers | Intensity of infestation | | | | All intensities |
|---|---|---|---|---|---|---|
| | | Light | Moderate | Heavy | Very heavy | |
| | Number | Acres | | | | |
| Oregon: | | | | | | |
| Umpqua N.F. | 167 | 175,680 | 106,400 | 34,240 | 1,920 | 318,240 |
| Siskiyou N.F. | 195 | 172,480 | 40,960 | 6,240 | 1,440 | 221,120 |
| Rogue River N.F. | 121 | 108,160 | 38,080 | 15,520 | 4,480 | 166,240 |
| Siuslaw N.F. | 108 | 110,880 | 23,840 | 5,760 | 0 | 140,480 |
| Umatilla N.F. | 28 | 7,200 | 6,880 | 0 | 0 | 14,080 |
| Mt. Hood N.F. | 15 | 4,640 | 2,880 | 0 | 0 | 7,520 |
| Willamette N.F. | 16 | 6,240 | 160 | 0 | 0 | 6,400 |
| Wallowa-Whitman N.F. | 11 | 1,920 | 2,400 | 0 | 0 | 4,320 |
| Malheur N.F. | 5 | 640 | 0 | 0 | 0 | 640 |
| NW. Oregon (O.S.B.F.) | 4 | 640 | 0 | 0 | 0 | 640 |
| Ochoco N.F. | 1 | 320 | 0 | 0 | 0 | 320 |
| Warm Springs I.R. | 1 | 160 | 0 | 0 | 0 | 160 |
| Oregon areas | 672 | 588,960 | 221,600 | 61,760 | 7,840 | 880,160 |
| Washington: | | | | | | |
| Colville I.R. | 50 | 8,120 | 19,040 | 1,600 | 0 | 28,760 |
| Okanogan N.F. | 22 | 8,320 | 800 | 0 | 0 | 9,120 |
| Wenatchee N.F. | 26 | 3,520 | 2,560 | 160 | 0 | 6,240 |
| Umatilla N.F. | 7 | 4,160 | 0 | 0 | 0 | 4,160 |
| Gifford Pinchot N.F. | 7 | 1,440 | 0 | 0 | 0 | 1,440 |
| Snoqualmie N.F. | 2 | 960 | 0 | 0 | 0 | 960 |
| Mt. Baker N.F. | 2 | 320 | 0 | 0 | 0 | 320 |
| Olympic N.F. | 1 | 160 | 0 | 0 | 0 | 160 |
| Yakima I.R. | 1 | 160 | 0 | 0 | 0 | 160 |
| Washington areas | 118 | 27,160 | 22,400 | 1,760 | 0 | 51,320 |
| All areas | 790 | 616,120 | 244,000 | 63,520 | 7,840 | 931,480 |

1/ Areas include damage on lands of all ownerships.

2/ N.F., national forest; I.R., Indian reservation; O.S.B.F., Oregon State Board of Forestry.

mortality over that of 1957 on the Umpqua, Rogue River, and Siskiyou National Forests. On the Siuslaw National Forest there was no significant trend, but the losses appeared to be static or slightly lower in 1958. Beetle brood production in 1958 was generally lighter on all areas, indicating a probable downward trend of tree killing for 1959.

The trend of losses in the region from 1955 through 1958 is shown in table 7. The heavy windthrow of December 1958, most of which is apparently in southwestern Washington, may serve to produce beetle broods that will become aggressive in 1960.

Considerable salvage logging to reduce beetle populations is underway. Continued efforts along this line are needed on areas of recent damage to recover timber values that would otherwise be lost through deterioration. Salvage of the recent windthrow is especially needed to reduce the likelihood of an epidemic population developing and spreading to green timber.

Table 7.--Trend of Douglas-fir beetle infestations in Oregon and Washington, 1951-58

(In acres)

| Year of detection | Area of epidemic infestations | | Regional total |
|---|---|---|---|
| | Oregon | Washington[1/] | |
| 1951 | 132,800 | 35,200 | 168,000 |
| 1952 | 4,111,730 | 458,400 | 4,570,130 |
| 1953 | 4,153,900 | 678,900 | 4,832,800 |
| 1954 | 4,440,540 | 631,210 | 5,071,750 |
| 1955 | 640,160 | 232,960 | 873,120 |
| 1956 | 20,770 | 96,130 | 116,900 |
| 1957 | 10,880 | 7,520 | 18,400 |
| 1958 | 880,160 | 51,320 | 931,480 |

[1/] Except Lincoln, Pend Oreille, Spokane, Whitman, and parts of Ferry and Stevens Counties.

## MOUNTAIN PINE BEETLE
Dendroctonus monticolae Hopk.

Epidemic outbreaks increased about 20 percent over last year's on a regionwide basis (table 8). The bulk of this increase occurred in western white pine stands in Washington. A decrease in lodgepole pine and sugar pine mortality and an increase of mortality in young ponderosa pine stands occurred in both States. The situation by tree species follows:

Western white pine.--The greatest increase was on the Mount Baker, Snoqualmie, and Gifford Pinchot National Forests in Washington, and on the Willamette National Forest in Oregon. In most of its range in both States, western white pine is infected with blister rust. The rust and beetle are most destructive to trees just reaching merchantable size, and this lethal combination of pests makes the management of western white pine in this region a costly undertaking of doubtful success.

Lodgepole pine.--Beetle activity in older infestation centers decreased for the third consecutive year, due in large part to fewer susceptible-sized host trees. The largest concentration of damage was on the Deschutes National Forest at Wanoga Butte. An outbreak in the Buck Lake area of the Rogue River National Forest has run its course and is subsiding.

Ponderosa pine.--Damage increased in extent and severity in pole-sized ponderosa pine stands on the Deschutes and Fremont National Forests and on the Klamath Indian Reservation.

Sugar pine.--A general increase in the amount of mature sugar pine killed by the mountain pine beetle occurred on the Umpqua, Rogue River, and Siskiyou National Forests in southern Oregon. Although this condition is subepidemic, careful watch should be kept for further possible increases in 1959.

Table 8.--Trend of mountain pine beetle infestations in Oregon and Washington, by host species, 1955-58[1/]

(In acres)

| Year of detection | Area of epidemic infestations | | | | | | Regional total all species |
|---|---|---|---|---|---|---|---|
| | Oregon | | | | Washington[2/] | | |
| | W | L | P | S | W | L | |
| 1955 | 12,110 | 52,410 | 2,060 | 0 | 81,120 | 27,240 | 174,940 |
| 1956 | 34,680 | 52,420 | 7,440 | 0 | 130,180 | 28,040 | 252,760 |
| 1957 | 29,280 | 73,920 | 640 | 160 | 102,560 | 5,440 | 212,000 |
| 1958 | 32,160 | 36,640 | 2,560 | 0 | 190,880 | 5,920 | 268,160 |

1/ Host species are: W, western white pine; L, lodgepole pine; P, ponderosa pine; S, sugar pine.

2/ Except Lincoln, Pend Oreille, Spokane, Whitman, and parts of Ferry and Stevens Counties.

## WESTERN PINE BEETLE
## Dendroctonus brevicomis Lec.

The regionwide increase noted in 1957 continued in 1958 (table 9). Generally the infestations were subepidemic and light epidemic in intensity, but on local areas they ranged from moderately to heavily epidemic. The grouping of attacks, characteristic of severe outbreaks, became more evident.

In Oregon, the largest increases occurred on the Snow Mountain District of the Ochoco National Forest, in the Dry Creek drainage of the Fremont National Forest, and in the Metolius Bench area of the Warm Springs Indian Reservation. Elsewhere tree killing was subepidemic but increasing. Aggressive infestation centers in Washington were found on the Okanogan National Forest, and on the Yakima, Colville, and Spokane Indian Reservations.

Control of the pine beetle by sanitation-salvage logging is in progress or is planned for most of the heaviest centers of infestation. The only direct control work against the beetle was done along the south entrance road to Crater Lake National Park, where the Park Service treated five trees with ethylene dibromide.

Table 9.--Trend of western pine beetle infestations in Oregon and Washington, 1955-58

(In acres)

| Year of detection | Area of epidemic infestations | | Regional total |
|---|---|---|---|
| | Oregon | Washington[1/] | |
| 1955 | 31,560 | 13,760 | 45,320 |
| 1956 | 13,920 | 2,110 | 16,030 |
| 1957 | 39,040 | 2,720 | 41,760 |
| 1958 | 96,640 | 56,080 | 152,720 |

1/ Except Lincoln, Pend Oreille, Spokane, Whitman, and parts of Ferry and Stevens Counties.

## ENGELMANN SPRUCE BEETLE
Dendroctonus engelmanni Hopk.

Epidemic infestations declined (table 10). The few remaining centers were in subalpine stands on the Wenatchee and Umatilla National Forests. Beetle broods were generally light, indicating a downward trend for 1959. Salvage is in progress, but is hampered because of low timber values and limited access.

Table 10.--Trend of Engelmann spruce beetle infestations in Oregon and Washington, 1955-58

(In acres)

| Year of detection | Area of epidemic infestation | | Regional total |
|---|---|---|---|
| | Oregon | Washington 1/ | |
| 1955 | 1,940 | 20,640 | 22,580 |
| 1956 | 11,160 | 3,720 | 14,880 |
| 1957 | 24,480 | 7,680 | 32,160 |
| 1958 | 4,640 | 3,840 | 8,480 |

1/ Except Lincoln, Pend Oreille, Spokane, Whitman, and parts of Ferry and Stevens Counties.

## FIR ENGRAVER
Scolytus ventralis Lec.

Losses caused by this beetle increased slightly (table 11). The damage occurred mainly in subalpine stands on the Wenatchee and Okanogan National Forests in Washington and on the Umatilla and Wallowa-Whitman National Forests in Oregon.

The heaviest mortality again occurred on the Umatilla National Forest in Oregon, with the largest concentrations in the Langdon Lake area. In this area, the true firs are being killed by the beetle and a root rot fungus. Control is impractical.

Table 11.--Trend of fir engraver infestations in Oregon and Washington, 1955-58

(In acres)

| Year of detection | Area of epidemic infestations | | Regional total |
|---|---|---|---|
| | Oregon | Washington[1/] | |
| 1955 | 31,160 | 19,360 | 50,520 |
| 1956 | 19,200 | 5,760 | 24,960 |
| 1957 | 9,920 | 11,360 | 21,280 |
| 1958 | 11,120 | 10,880 | 22,000 |

1/ Except Lincoln, Pend Oreille, Spokane, Whitman, and parts of Ferry and Stevens Counties.

## OREGON PINE IPS
Ips oregoni (Eichh.)

Damage to young ponderosa pine stands caused by this insect declined for the second successive year (table 12). The centers of heaviest damage in Oregon were in fringe stands in the vicinity of Grants Pass, Oreg. East of the Cascade Range in Oregon, damage was of no great importance and was widely scattered. In Washington, centers of light epidemic intensity were found in fringe stands of the Colville Indian Reservation, west of Nespelem, Wash.

Proper handling of logging and thinning slash offers the most practical means of keeping losses to a minimum. Direct control is seldom, if ever, warranted.

Table 12.--Trend of Oregon pine ips infestations in Oregon and Washington, 1955-58

(In acres)

| Year of detection | Area of epidemic infestations | | Regional total |
|---|---|---|---|
| | Oregon | Washington[1/] | |
| 1955 | 46,950 | 4,960 | 51,910 |
| 1956 | 82,720 | 9,220 | 91,940 |
| 1957 | 26,880 | 1,760 | 28,640 |
| 1958 | 7,680 | 3,320 | 11,000 |

1/ Except Lincoln, Pend Oreille, Spokane, Whitman, and parts of Ferry and Stevens Counties.

## SILVER FIR BEETLES
## Pseudohylesinus spp.

Light epidemic outbreaks of silver fir beetles[1/] increased on the Mount Baker and Snoqualmie National Forests in Washington (table 13). Although tree killing generally was far short of that experienced during the recent severe epidemic, the apparent upward trend warrants close watching.

In 1958, private, State, and Federal cooperators examined 275 trend plots established in 1954 in the Mount Baker and Olympic Peninsula areas to observe annual mortality of Pacific silver fir and western hemlock. On the plots in the Mount Baker area the vigor of Pacific silver fir declined, and tree mortality resulting from bark beetles, disease, windthrow, and unknown causes increased to 12.5 percent of the stand. In the Olympic area, mortality of Pacific silver fir was negligible and the condition of the green trees continued to be good.

1/ "Silver fir beetles" is a local name given to two species of Pseudohylesinus: P. grandis Sw., the grand fir bark beetle; and P. granulatus (Lec.), the fir root bark beetle.

No effective control measures have been developed for these insects, which are primarily destructive in overmature and decadent stands. The only practical action is to utilize the timber on affected areas where tree killing has begun or is imminent.

Table 13.--Trend of silver fir beetle infestations in Oregon and Washington, 1949-58

(In acres)

| Year of detection | Area of epidemic infestations | | Regional total |
|---|---|---|---|
| | Oregon | Washington[1/] | |
| 1949 | 0 | 38,000 | 38,000 |
| 1950 | 0 | 55,000 | 55,000 |
| 1951 | 0 | 243,000 | 243,000 |
| 1952 | 0 | [2/]162,440 | 162,440 |
| 1953 | 0 | 543,840 | 543,840 |
| 1954 | 16,390 | 635,840 | 652,230 |
| 1955 | 4,320 | 110,400 | 114,720 |
| 1956 | 0 | 0 | 0 |
| 1957 | 0 | 1,120 | 1,120 |
| 1958 | 0 | 4,720 | 4,720 |

[1/] Except Lincoln, Pend Oreille, Spokane, Whitman, and parts of Ferry and Stevens Counties.

[2/] Survey incomplete.

## OTHER INSECTS

Many forest insects other than those discussed have caused extensive damage in the past, and some may cause serious damage in the future. For this reason, it is desirable to follow the trend of these insects so that any increase will be noted and reported promptly.

Brief statements on the status of some of these insects in 1958 follow. None of the insects require control at present.

## Defoliators

### Douglas-Fir Tussock Moth (Hemerocampa pseudotsugata McD.)

Some very light feeding was observed in August on Douglas-fir near Hat Point on the Wallowa-Whitman National Forests. Near Woodland, Wash., one tree was totally defoliated. Examination of current egg masses from this tree indicated a heavy egg parasitism by a small hymenopteron. The Woodland infestation is of interest because it occurred in the Douglas-fir region, an area in which the tussock moth has not been found in epidemic numbers in the forest, despite its destructiveness east of the Cascade Range.

### Western Hemlock Looper (Lambdina fiscellaria lugubrosa Hulst)

In 1958 this looper was reported in eastern Oregon for the first time. Several larvae were taken from white fir in the vicinity of Joseph and along the Imnaha River on the Wallowa-Whitman National Forests. No appreciable damage to the trees was noted.

### Western Oak Looper (Lambdina fiscellaria somniaria Hulst)

Infested Oregon white oak was detected near Springfield, Oreg., and at other widely scattered points in the Willamette Valley. An oak stand in the city park at Centralia, Wash., was also attacked. The feeding causes no permanent damage since the oaks are able to leaf out again the following year. In the past, outbreaks of the oak looper have occurred about the same time as have those of the hemlock looper in coastal forests, hence special search for the latter insect in the next few years is warranted.

### Spruce Tip Moth (Griselda radicana (Wlsm.))

The occurrence of this moth in Douglas-fir and white fir stands in eastern Oregon was spotty, and damage resulting from its feeding was minor. In most areas where it was found, it was outnumbered by the spruce budworm.

Unknown Moth
Family Saturniidae

A group of ponderosa pines on Dooley Mountain on the Wallowa-Whitman National Forests was lightly defoliated by larvae that closely resembled the pandora moth. The defoliation was visible on both large and small trees. The area in which this damage occurred was sprayed during the 1958 spruce budworm project.

Fir Sawfly
(Neodiprion sp.)

Noble fir at the headwaters of the Clackamas River on the Mount Hood National Forest was fed upon to the point that cutters of Christmas greens expressed some concern. Elsewhere in the region sawfly feeding on true firs was more pronounced than in 1957, but was still not epidemic.

Douglas-Fir Sawfly
(Neodiprion sp.)

Several acres of Douglas-fir saplings and reproduction near Puyallup, Wash., were partially defoliated early in the spring. Later, aerial surveys failed to reveal any defoliated areas. Laboratory rearings of mature larvae failed to show the presence of any parasites. From experience, it is assumed that this is a local flareup that will soon subside.

## Weevils

Sitka-Spruce Weevil
(Pissodes sitchensis Hopk.)

Reports of damage were received from many points in coastal Oregon. This type of damage is prevalent and relatively constant from year to year. Leader weeviling of young spruce increased 4 to 9 percent on permanent study plots at Cascade Head and in the Youngs River drainage. Research studies to test the weevil susceptibility of a number of spruce species and hybrids are now underway.

Bark Weevil
(Pissodes piperi Hopk.)

On a tree farm in the Mollala River drainage, weevils bred in a 90-year-old noble fir stand that had sustained rather extensive windbreak and snowbreak and began to attack surrounding green trees. Intermediate and suppressed trees were the preferred hosts. Current thinning operations are expected to improve the vigor of the reserve stand and minimize damage by the weevil.

## Aphids

Spruce Aphid
(Aphis abietina (Wlkr.))

The severe outbreaks of this aphid that occurred in 1956 in coastal Oregon and Washington have been brought under control by natural factors, principally insect parasites. In 1957, one collection showed approximately 85 percent of the aphid population to be parasitized by braconid, chalcid, and cynipid wasps.

## Seed and Cone Insects

Although no quantitative data are available, general indications are that a large part of the Douglas-fir, Sitka spruce, and ponderosa pine seed crop in 1958 was destroyed by insects. Damage of this type is increasingly important since more and more effort is going into the production and harvesting of tree seeds.

## Range Insects

Insects reduce the amount of range forage available for livestock and wildlife. Just how important the insects are and how their damage can be checked have not been fully determined, but progress is being made in a cooperative study with Oregon State College. This study, begun in 1957 and continued in 1958, primarily concerns the insects attacking bitterbrush, an important winter browse plant for deer.

Of the many insects that attack bitterbrush, none was destructively epidemic in 1958. The Great Basin tent caterpillar (Malacosoma fragilis Stretch) was most conspicuously abundant, causing appreciable damage in Deschutes and Lake Counties, Oreg.

A 1957 outbreak of the bitterbrush looper (Anacamptodes sp.) near Boardman, Oreg., subsided after causing much damage.

## OTHER FOREST PEST PROBLEMS

### Dying Hemlock

Western hemlock mortality that first became evident in 1954 was greatly reduced in 1958 (table 14). Cause or causes of this mortality are unknown. The areas of heaviest losses were on the Mount Baker National Forest and in southwestern Washington. Data gathered from trend plots showed that the overall condition of hemlock stands remained good and that current losses were extremely low.

Table 14.--Trend of dying western hemlock in Oregon and Washington, 1954-58

(In acres)

| Year of detection | Area of damage | | Regional total |
|---|---|---|---|
| | Oregon | Washington[1/] | |
| 1954 | 0 | 75,200 | 75,200 |
| 1955 | 11,680 | 57,120 | 68,800 |
| 1956 | 3,520 | 122,440 | 125,960 |
| 1957 | 640 | 245,760 | 246,400 |
| 1958 | 0 | 46,400 | 46,400 |

1/ Except Lincoln, Pend Oreille, Spokane, Whitman, and parts of Ferry and Stevens Counties.

### Bear Damage

Damage caused by bears declined for a third successive year, with the heaviest remaining centers on the Gifford Pinchot and Olympic National Forests and in southwestern Washington. Bears have killed and damaged many young conifers on extensive areas in western Oregon and western Washington since 1951 (table 15). Stands sustaining the most severe losses usually were those already understocked.

Table 15.--Trend of bear damage in western Oregon and western Washington, 1951-58

(In acres)

| Year of detection | Western Oregon | Western Washington | Regional total |
|---|---|---|---|
| 1951 | 0 | 208,800 | 208,800 |
| 1952 | 2,560 | 36,160 | 38,720 |
| 1953 | 18,080 | 118,240 | 136,320 |
| 1954 | 97,750 | 194,560 | 292,310 |
| 1955 | 120,800 | 173,760 | 294,560 |
| 1956 | 100,140 | 344,000 | 444,140 |
| 1957 | 101,920 | 103,040 | 204,960 |
| 1958 | 54,700 | 118,500 | 173,200 |

# APPENDIX

## Organization and Conduct of Surveys

### Aerial Surveys

As in recent years, the regional aerial survey was a joint effort by four organizations: Oregon State Board of Forestry, Washington State Department of Natural Resources, Weyerhaeuser Timber Co., and the Pacific Northwest Forest and Range Experiment Station. Flying time totaled 262.7 hours (table 16). The bulk of the flying was done between July 7 and August 7, with some flights later in the season to detect balsam woolly aphid infestations in subalpine fir.

Flying in Washington was done in a plane contracted for by the Experiment Station. P. W. Orr, Experiment Station, and Kenneth Turnbull, Washington State Department of Natural Resources, acted as observers. Weyerhaeuser Timber Co. lands were surveyed by P. G. Lauterbach, observer, and R. Chapman, pilot, in a company plane.

In Oregon, the State Board of Forestry provided the services of A. T. Larsen, pilot, and 60 hours of flying time in a State-owned

plane. The Experiment Station contracted with the State for use of the plane and pilot for an additional 50 hours of flying time to complete the survey. W. J. Buckhorn and L. F. Pettinger were the observers in the State plane. Weyerhaeuser Timber Co. lands in Oregon were surveyed by P. G. Lauterbach and R. Chapman.

Table 16.--Summary of cooperative aerial survey activities in 1958

| Area covered | Timbered area surveyed | Survey time | | |
|---|---|---|---|---|
| | | Mapping | Ferrying | Total |
| | M acres | ---------- Hours ---------- | | |
| Western Oregon | 15,670 | 73.3 | 10.5 | 83.8 |
| Eastern Oregon Cascades | 6,591 | 16.3 | 1.1 | 17.4 |
| Blue Mountains | 6,964 | 25.8 | 3.6 | 29.4 |
| Western Washington | 11,774 | 72.0 | 3.9 | 75.9 |
| Eastern Washington[1/] | 7,148 | 53.5 | 2.7 | 56.2 |
| All areas | 48,147 | 240.9 | 21.8 | 262.7 |

[1/] Except Lincoln, Pend Oreille, Spokane, Whitman, and parts of Ferry and Stevens Counties.

In the two States, Weyerhaeuser Timber Co.'s total flying time amounted to about 50 hours. The Company survey was made according to previously agreed standards so it could be readily incorporated into the regional summary.

## Ground Surveys

Aerial survey findings were ground checked by W. J. Buckhorn, P. W. Orr, L. F. Pettinger, R. Hunt, and J. Grunwald of the Experiment Station to verify the identity of the insects and the degree of infestation, and to determine the population trend. Oregon State Board of Forestry provided the services of E. Pearson for ground checking in Oregon.

An evaluation of the spruce budworm population in the egg stage was made on plots established in eastern Oregon by W. Klein, R. Hunt, and J. Grunwald under the direction of V. M. Carolin, Jr.

The detailed counts of the foliage samples were made under the direction of research personnel. A ground survey was made early in the season to determine the status of the budworm on the Willamette, Mount Hood, Gifford Pinchot, Snoqualmie, and Wenatchee National Forests--areas on which no epidemic infestation has been mapped in the past several years.

Data for the appraisal of the Douglas-fir beetle outbreak in southwestern Oregon were gathered by L. F. Pettinger, R. Hunt, and J. Grunwald of the Experiment Station, and E. Pearson of Oregon State Board of Forestry.

L. F. Pettinger and J. Grunwald assisted A. T. Burniskey, Bureau of Indian Affairs, in recruising several 320-acre pine beetle trend plots on the Warm Springs Indian Reservation.

Members of a committee of the Northwest Forest Pest Action Council and cooperators examined 275 trend plots to determine the status of the silver fir beetles and dying western hemlock.

Cooperators--private, State, and Federal--were asked to report abnormal activity by insects, diseases, and animals. A total of 106 reports disclosed 70 cases of insect damage, 12 cases of disease, and 24 cases of animal damage.

Table 17.--Extent of epidemic infestations in Oregon in 1958, by forest area, insect species, and intensity of infestation

| Administrative area and insects involved[1/ 2/] | Infestation centers | Intensity of infestation | | | | All intensities |
|---|---|---|---|---|---|---|
| | | Light | Moderate | Heavy | Very heavy | |
| | Number | Acres | | | | |
| Deschutes N.F. and adjacent forest lands: | | | | | | |
| Spruce budworm | 1 | 2,080 | 0 | 0 | 0 | 2,080 |
| Pandora moth | 1 | 1,600 | 0 | 0 | 0 | 1,600 |
| Balsam woolly aphid | 4 | 2,080 | 0 | 0 | 0 | 2,080 |
| Mt. pine beetle (L) | 12 | 9,440 | 4,000 | 320 | 0 | 13,760 |
| Mt. pine beetle (P) | 2 | 1,760 | 0 | 0 | 0 | 1,760 |
| Western pine beetle | 6 | 3,840 | 0 | 0 | 0 | 3,840 |
| All insects | 26 | 20,800 | 4,000 | 320 | 0 | 25,120 |
| Fremont N.F. and adjacent forest lands: | | | | | | |
| Spruce budworm | 4 | 38,880 | 0 | 0 | 0 | 38,880 |
| Pine needle miner | 1 | 160 | 0 | 0 | 0 | 160 |
| Mt. pine beetle (L) | 19 | 2,080 | 4,960 | 0 | 2,080 | 9,120 |
| Mt. pine beetle (P) | 1 | 0 | 480 | 0 | 0 | 480 |
| Western pine beetle | 12 | 3,360 | 160 | 0 | 0 | 3,520 |
| Fir engraver | 2 | 960 | 0 | 0 | 0 | 960 |
| Oregon pine ips | 5 | 320 | 0 | 160 | 0 | 480 |
| All insects | 44 | 45,760 | 5,600 | 160 | 2,080 | 53,600 |

See footnotes at end of table.

Table 17.--Extent of epidemic infestations in Oregon in 1958 ... (Continued)

| Administrative area and insects involved[1/ 2/] | Infestation centers | Intensity of infestation | | | | All intensities |
|---|---|---|---|---|---|---|
| | | Light | Moderate | Heavy | Very heavy | |
| | Number | Acres | | | | |
| Malheur N.F. and adjacent forest lands: | | | | | | |
| Spruce budworm | 17 | 25,120 | 640 | 0 | 0 | 25,760 |
| Douglas-fir beetle | 5 | 640 | 0 | 0 | 0 | 640 |
| Mt. pine beetle (L) | 1 | 160 | 0 | 0 | 0 | 160 |
| Western pine beetle | 7 | 3,200 | 0 | 0 | 0 | 3,200 |
| Fir engraver | 3 | 480 | 0 | 0 | 0 | 480 |
| Oregon pine ips | 4 | 320 | 160 | 0 | 0 | 480 |
| All insects | 37 | 29,920 | 800 | 0 | 0 | 30,720 |
| Mt. Hood N.F. and adjacent forest lands: | | | | | | |
| Balsam woolly aphid | 59 | 20,800 | 8,800 | 0 | 0 | 29,600 |
| Douglas-fir beetle | 15 | 4,640 | 2,880 | 0 | 0 | 7,520 |
| Mt. pine beetle (W) | 13 | 5,600 | 1,440 | 0 | 0 | 7,040 |
| Western pine beetle | 7 | 4,640 | 0 | 0 | 0 | 4,640 |
| Oregon pine ips | 2 | 160 | 0 | 320 | 0 | 480 |
| All insects | 96 | 35,840 | 13,120 | 320 | 0 | 49,280 |

See footnotes at end of table.

Table 17.--Extent of epidemic infestations in Oregon in 1958 ... (Continued)

| Administrative area and insects involved[1/ 2/] | Infestation centers | Intensity of infestation | | | | All intensities |
|---|---|---|---|---|---|---|
| | | Light | Moderate | Heavy | Very heavy | |
| | Number | Acres | | | | |
| Ochoco N.F. and adjacent forest lands: | | | | | | |
| Spruce budworm | 1 | 6,400 | 0 | 0 | 0 | 6,400 |
| Douglas-fir beetle | 1 | 320 | 0 | 0 | 0 | 320 |
| Western pine beetle | 22 | 18,400 | 27,520 | 8,320 | 0 | 54,240 |
| Oregon pine ips | 4 | 480 | 160 | 0 | 0 | 640 |
| All insects | 28 | 25,600 | 27,680 | 8,320 | 0 | 61,600 |
| Rogue River N.F. and adjacent forest lands: | | | | | | |
| Douglas-fir beetle | 121 | 108,160 | 38,080 | 15,520 | 4,480 | 166,240 |
| Mt. pine beetle (L) | 6 | 1,920 | 0 | 1,280 | 480 | 3,680 |
| Western pine beetle | 6 | 800 | 160 | 0 | 0 | 960 |
| Fir engraver | 3 | 400 | 0 | 0 | 0 | 400 |
| Oregon pine ips | 10 | 160 | 800 | 960 | 0 | 1,920 |
| All insects | 146 | 111,440 | 39,040 | 17,760 | 4,960 | 173,200 |
| Siskiyou N.F. and adjacent forest lands: | | | | | | |
| Douglas-fir beetle | 195 | 172,480 | 40,960 | 6,240 | 1,440 | 221,120 |
| Western pine beetle | 2 | 320 | 0 | 0 | 0 | 320 |
| Oregon pine ips | 1 | 0 | 0 | 160 | 0 | 160 |
| All insects | 198 | 172,800 | 40,960 | 6,400 | 1,440 | 221,600 |

See footnotes at end of table.

Table 18.--Extent of epidemic infestations in Washington in 1958, by forest area, insect species, and intensity of infestation[1/]

| Administrative area and insects involved[2/ 3/] | Infestation centers | Intensity of infestation | | | | All intensities |
|---|---|---|---|---|---|---|
| | | Light | Moderate | Heavy | Very heavy | |
| | Number | Acres | | | | |
| Gifford Pinchot N.F. and adjacent forest lands: | | | | | | |
| Balsam woolly aphid | 56 | 72,290 | 34,010 | 15,140 | 4,960 | 126,400 |
| Douglas-fir beetle | 7 | 1,440 | 0 | 0 | 0 | 1,440 |
| Mt. pine beetle (W) | 87 | 17,760 | 19,040 | 20,160 | 2,720 | 59,680 |
| Western pine beetle | 3 | 5,920 | 0 | 0 | 0 | 5,920 |
| All insects | 153 | 97,410 | 53,050 | 35,300 | 7,680 | 193,440 |
| Mt. Baker N.F. and adjacent forest lands: | | | | | | |
| Douglas-fir beetle | 2 | 320 | 0 | 0 | 0 | 320 |
| Mt. pine beetle (W) | 98 | 13,280 | 11,680 | 4,320 | 0 | 29,280 |
| Engelmann spruce beetle | 2 | 320 | 0 | 0 | 0 | 320 |
| Fir engraver | 5 | 800 | 320 | 0 | 0 | 1,120 |
| Silver fir beetles | 18 | 2,800 | 0 | 0 | 0 | 2,800 |
| All insects | 125 | 17,520 | 12,000 | 4,320 | 0 | 33,840 |

See footnotes at end of table.

Table 17.--Extent of epidemic infestations in Oregon in 1958 ... (Continued)

| Administrative area and insects involved[1/ 2/] | Infestation centers | Intensity of infestation | | | | All intensities |
|---|---|---|---|---|---|---|
| | | Light | Moderate | Heavy | Very heavy | |
| | Number | Acres | | | | |
| Klamath I.R.: | | | | | | |
| Mt. pine beetle (L) | 11 | 5,280 | 800 | 960 | 0 | 7,040 |
| Mt. pine beetle (P) | 1 | 320 | 0 | 0 | 0 | 320 |
| Western pine beetle | 1 | 640 | 0 | 0 | 0 | 640 |
| All insects | 13 | 6,240 | 800 | 960 | 0 | 8,000 |
| Warm Springs I.R.: | | | | | | |
| Balsam woolly aphid | 5 | 2,080 | 480 | 0 | 0 | 2,560 |
| Douglas-fir beetle | 1 | 160 | 0 | 0 | 0 | 160 |
| Mt. pine beetle (L) | 2 | 800 | 160 | 0 | 0 | 960 |
| Western pine beetle | 11 | 22,240 | 1,920 | 0 | 0 | 24,160 |
| All insects | 19 | 25,280 | 2,560 | 0 | 0 | 27,840 |
| Northwest Oregon (O.S.B.F.): | | | | | | |
| Spruce bud moth | 1 | 800 | 0 | 0 | 0 | 800 |
| Douglas-fir beetle | 4 | 640 | 0 | 0 | 0 | 640 |
| All insects | 5 | 1,440 | 0 | 0 | 0 | 1,440 |
| Lookout Mountain (B.L.M.): | | | | | | |
| Spruce budworm | 3 | 0 | 0 | 2,000 | 0 | 2,000 |

1/ Mountain pine beetle damage has been separated by tree species attacked: L, lodgepole pine; W, western white pine; P, ponderosa pine.

2/ Administrative areas are abbreviated as follows: N.F., national forest; N.P., national park; I.R., Indian reservation; O.S.B.F., Oregon State Board of Forestry; B.L.M., Bureau of Land Management.

Table 17.--Extent of epidemic infestations in Oregon in 1958 ... (Continued)

| Administrative area and insects involved[1/ 2/] | Infestation centers | Intensity of infestation | | | | All intensities |
|---|---|---|---|---|---|---|
| | | Light | Moderate | Heavy | Very heavy | |
| | Number | Acres | | | | |
| Wallowa-Whitman N.F. and adjacent forest lands: | | | | | | |
| Spruce budworm | 58 | 167,360 | 58,560 | 14,400 | 0 | 240,320 |
| Douglas-fir beetle | 11 | 1,920 | 2,400 | 0 | 0 | 4,320 |
| Mt. pine beetle (L) | 4 | 640 | 0 | 0 | 0 | 640 |
| Western pine beetle | 2 | 320 | 0 | 0 | 0 | 320 |
| Engelmann spruce beetle | 4 | 1,120 | 480 | 0 | 0 | 1,600 |
| Fir engraver | 18 | 3,200 | 800 | 160 | 0 | 4,160 |
| Oregon pine ips | 12 | 1,600 | 640 | 0 | 0 | 2,240 |
| All insects | 109 | 176,160 | 62,880 | 14,560 | 0 | 253,600 |
| Willamette N.F. and adjacent forest lands: | | | | | | |
| Lodgepole pine sawfly | 1 | 320 | 0 | 0 | 0 | 320 |
| Balsam woolly aphid | 41 | 42,880 | 12,640 | 0 | 0 | 55,520 |
| Douglas-fir beetle | 16 | 6,240 | 160 | 0 | 0 | 6,400 |
| Mt. pine beetle (W) | 45 | 13,920 | 9,120 | 960 | 0 | 24,000 |
| All insects | 103 | 63,360 | 21,920 | 960 | 0 | 86,240 |
| Crater Lake N.P.: | | | | | | |
| Mt. pine beetle (L) | 1 | 0 | 960 | 0 | 0 | 960 |
| Fir engraver | 1 | 160 | 0 | 0 | 0 | 160 |
| All insects | 2 | 160 | 960 | 0 | 0 | 1,120 |

See footnotes at end of table.

Table 17.--Extent of epidemic infestations in Oregon in 1958 ... (Continued)

| Administrative area and insects involved[1/ 2/] | Infestation centers | Intensity of infestation | | | | All intensities |
|---|---|---|---|---|---|---|
| | | Light | Moderate | Heavy | Very heavy | |
| | Number | Acres | | | | |
| Siuslaw N.F. and adjacent forest lands: | | | | | | |
| Spruce bud moth | 13 | 3,200 | 800 | 0 | 0 | 4,000 |
| Balsam woolly aphid | 1 | 7,520 | 10,560 | 480 | 0 | 18,560 |
| Douglas-fir beetle | 108 | 110,880 | 23,840 | 5,760 | 0 | 140,480 |
| All insects | 122 | 121,600 | 35,200 | 6,240 | 0 | 163,040 |
| Umatilla N.F. and adjacent forest lands: | | | | | | |
| Douglas-fir beetle | 28 | 7,200 | 6,880 | 0 | 0 | 14,080 |
| Mt. pine beetle (L) | 2 | 320 | 0 | 0 | 0 | 320 |
| Western pine beetle | 2 | 800 | 0 | 0 | 0 | 800 |
| Engelmann spruce beetle | 5 | 1,920 | 1,120 | 0 | 0 | 3,040 |
| Fir engraver | 8 | 4,640 | 320 | 0 | 0 | 4,960 |
| Oregon pine ips | 5 | 480 | 800 | 0 | 0 | 1,280 |
| All insects | 50 | 15,360 | 9,120 | 0 | 0 | 24,480 |
| Umpqua N.F. and adjacent forest lands: | | | | | | |
| Balsam woolly aphid | 2 | 2,240 | 0 | 0 | 0 | 2,240 |
| Douglas-fir beetle | 167 | 175,680 | 106,400 | 34,240 | 1,920 | 318,240 |
| Mt. pine beetle (W) | 9 | 1,120 | 0 | 0 | 0 | 1,120 |
| All insects | 178 | 179,040 | 106,400 | 34,240 | 1,920 | 321,600 |

See footnotes at end of table.

Table 18.--Extent of epidemic infestations in Washington in 1958 ... (Continued)

| Administrative area and insects involved[2/ 3/] | Infestation centers | Intensity of infestation | | | | All intensities |
|---|---|---|---|---|---|---|
| | | Light | Moderate | Heavy | Very heavy | |
| | Number | Acres | | | | |
| Okanogan N.F. and adjacent forest lands: | | | | | | |
| Douglas-fir beetle | 22 | 8,320 | 800 | 0 | 0 | 9,120 |
| Mt. pine beetle (L) | 2 | 0 | 640 | 0 | 0 | 640 |
| Western pine beetle | 25 | 5,440 | 1,440 | 160 | 0 | 7,040 |
| Fir engraver | 13 | 2,240 | 1,280 | 0 | 0 | 3,520 |
| Oregon pine ips | 2 | 480 | 0 | 0 | 0 | 480 |
| All insects | 64 | 16,480 | 4,160 | 160 | 0 | 20,800 |
| Olympic N.F. and adjacent forest lands: | | | | | | |
| Spruce bud moth | 1 | 480 | 0 | 0 | 0 | 480 |
| Douglas-fir beetle | 1 | 160 | 0 | 0 | 0 | 160 |
| Mt. pine beetle (W) | 72 | 17,280 | 4,480 | 320 | 0 | 22,080 |
| Fir engraver | 1 | 0 | 160 | 0 | 0 | 160 |
| Silver fir beetles | 3 | 640 | 0 | 0 | 0 | 640 |
| All insects | 78 | 18,560 | 4,640 | 320 | 0 | 23,520 |

See footnotes at end of table.

Table 18.--Extent of epidemic infestations in Washington in 1958 ... (Continued)

| Administrative area and insects involved[2/ 3/] | Infestation centers | Intensity of infestation | | | | All intensities |
|---|---|---|---|---|---|---|
| | | Light | Moderate | Heavy | Very heavy | |
| | Number | Acres | | | | |
| Snoqualmie N.F. and adjacent forest lands: | | | | | | |
| Larch bud moth | 24 | 9,600 | 6,720 | 0 | 0 | 16,320 |
| Black-headed budworm | 2 | 960 | 0 | 0 | 0 | 960 |
| Balsam woolly aphid | 8 | 6,080 | 0 | 0 | 0 | 6,080 |
| Douglas-fir beetle | 2 | 960 | 0 | 0 | 0 | 960 |
| Mt. pine beetle (W) | 89 | 18,080 | 13,280 | 1,920 | 0 | 33,280 |
| Engelmann spruce beetle | 4 | 160 | 640 | 0 | 0 | 800 |
| Fir engraver | 5 | 960 | 320 | 0 | 0 | 1,280 |
| Silver fir beetles | 4 | 1,280 | 0 | 0 | 0 | 1,280 |
| All insects | 138 | 38,080 | 20,960 | 1,920 | 0 | 60,960 |
| Umatilla N.F. and adjacent forest lands: | | | | | | |
| Douglas-fir beetle | 7 | 4,160 | 0 | 0 | 0 | 4,160 |
| Mt. pine beetle (L) | 1 | 0 | 1,600 | 0 | 0 | 1,600 |
| Western pine beetle | 1 | 160 | 0 | 0 | 0 | 160 |
| Engelmann spruce beetle | 2 | 800 | 0 | 0 | 0 | 800 |
| Oregon pine ips | 1 | 160 | 0 | 0 | 0 | 160 |
| All insects | 12 | 5,280 | 1,600 | 0 | 0 | 6,880 |

See footnotes at end of table.

Table 18.--Extent of epidemic infestations in Washington in 1958 ... (Continued)

| Administrative area and insects involved[2/ 3/] | Infestation centers | Intensity of infestation | | | | All intensities |
|---|---|---|---|---|---|---|
| | | Light | Moderate | Heavy | Very heavy | |
| | Number | Acres | | | | |
| Wenatchee N.F. and adjacent forest lands: | | | | | | |
| Larch bud moth | 7 | 6,240 | 6,400 | 800 | 0 | 13,440 |
| Black-headed budworm | 7 | 640 | 1,120 | 0 | 0 | 1,760 |
| Balsam woolly aphid | 1 | 480 | 0 | 0 | 0 | 480 |
| Pine needle scale | 6 | 0 | 0 | 9,760 | 0 | 9,760 |
| Douglas-fir beetle | 26 | 3,520 | 2,560 | 160 | 0 | 6,240 |
| Mt. pine beetle (L) | 6 | 1,760 | 960 | 320 | 0 | 3,040 |
| Mt. pine beetle (W) | 51 | 6,080 | 6,560 | 2,720 | 0 | 15,360 |
| Western pine beetle | 17 | 3,680 | 0 | 0 | 0 | 3,680 |
| Engelmann spruce beetle | 6 | 1,600 | 320 | 0 | 0 | 1,920 |
| Fir engraver | 18 | 2,240 | 2,080 | 0 | 0 | 4,320 |
| Oregon pine ips | 3 | 640 | 320 | 0 | 0 | 960 |
| All insects | 148 | 26,880 | 20,320 | 13,760 | 0 | 60,960 |
| Mt. Rainier N.P.: | | | | | | |
| Mt. pine beetle (W) | 6 | 1,600 | 320 | 0 | 0 | 1,920 |
| Olympic N.P.: | | | | | | |
| Mt. pine beetle (W) | 78 | 16,800 | 8,000 | 0 | 0 | 24,800 |
| Fir engraver | 2 | 0 | 160 | 0 | 0 | 160 |
| All insects | 80 | 16,800 | 8,160 | 0 | 0 | 24,960 |

See footnotes at end of table.

Table 18.--Extent of epidemic infestations in Washington in 1958 ... (Continued)

| Administrative area and insects involved[2/ 3/] | Infestation centers | Intensity of infestation | | | | All intensities |
|---|---|---|---|---|---|---|
| | | Light | Moderate | Heavy | Very heavy | |
| | Number | Acres | | | | |
| Colville I.R.: | | | | | | |
| Larch bud moth | 7 | 960 | 3,840 | 480 | 0 | 5,280 |
| Pine needle scale | 1 | 640 | 0 | 0 | 0 | 640 |
| Douglas-fir beetle | 50 | 8,120 | 19,040 | 1,600 | 0 | 28,760 |
| Mt. pine beetle (L) | 1 | 480 | 0 | 0 | 0 | 480 |
| Western pine beetle | 6 | 4,000 | 0 | 0 | 0 | 4,000 |
| Fir engraver | 1 | 0 | 160 | 0 | 0 | 160 |
| Oregon pine ips | 5 | 960 | 160 | 0 | 0 | 1,120 |
| All insects | 71 | 15,160 | 23,200 | 2,080 | 0 | 40,440 |
| Quinault I.R.: | | | | | | |
| Mt. pine beetle (W) | 5 | 4,480 | 0 | 0 | 0 | 4,480 |
| Yakima I.R.: | | | | | | |
| Larch bud moth | 7 | 6,400 | 480 | 0 | 0 | 6,880 |
| Douglas-fir beetle | 1 | 160 | 0 | 0 | 0 | 160 |
| Mt. pine beetle (L) | 1 | 160 | 0 | 0 | 0 | 160 |
| Western pine beetle | 26 | 19,840 | 4,000 | 0 | 0 | 23,840 |
| Fir engraver | 1 | 0 | 160 | 0 | 0 | 160 |
| All insects | 36 | 26,560 | 4,640 | 0 | 0 | 31,200 |

See footnotes at end of table.

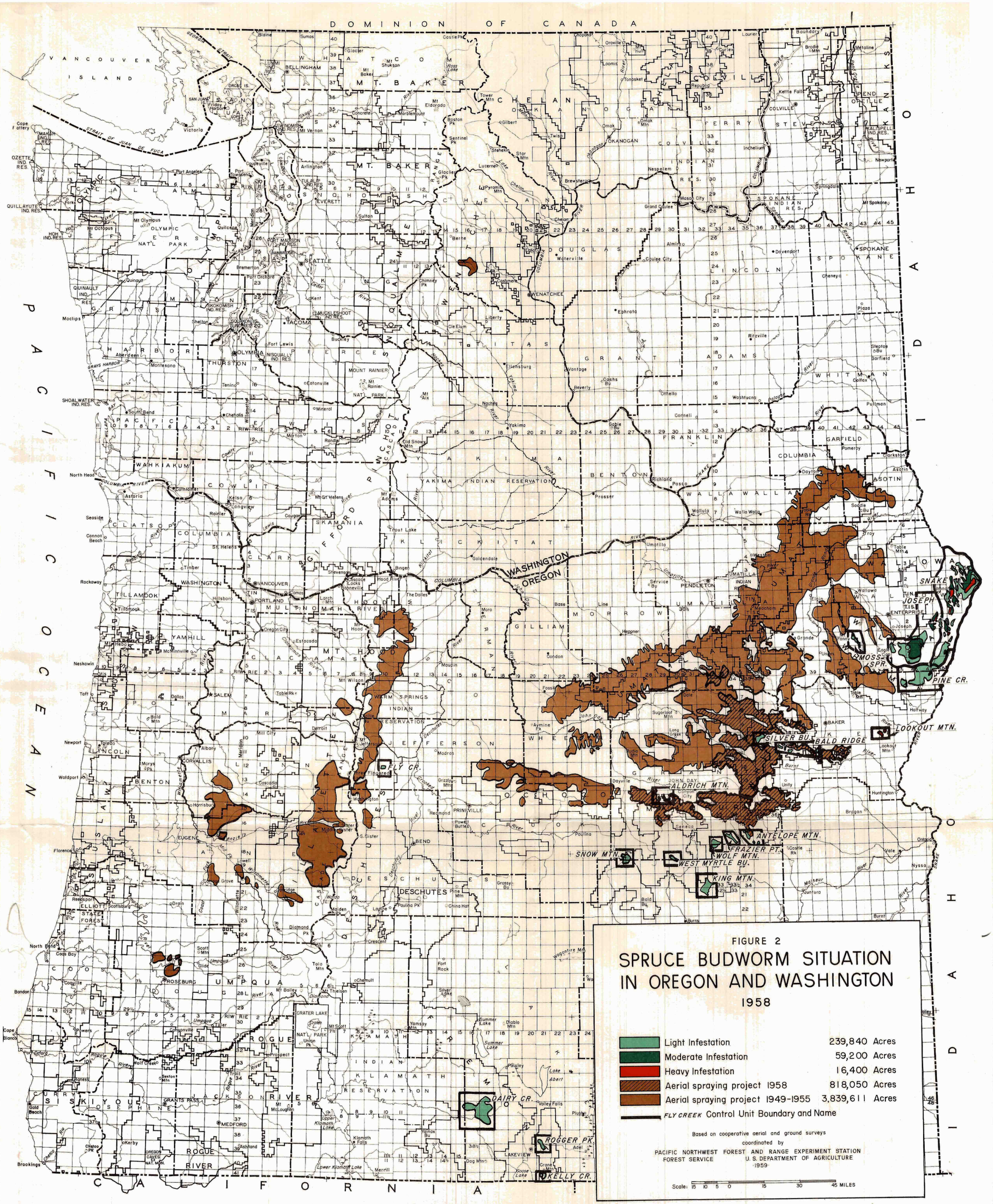
Table 18.--Extent of epidemic infestations in Washington in 1958 ... (Continued)

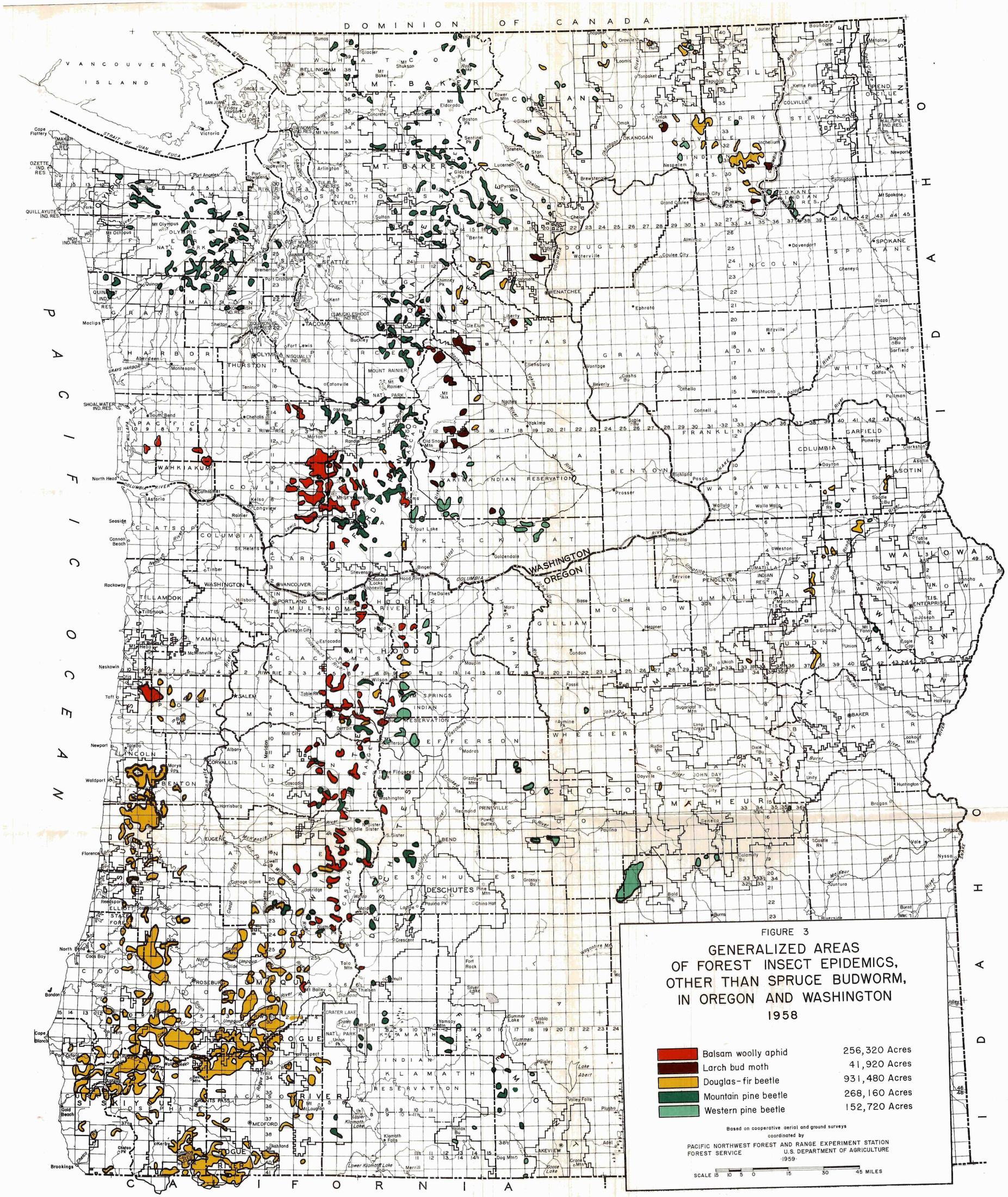
| Administrative area and insects involved[2/ 3/] | Infestation centers | Intensity of infestation | | | | All intensities |
|---|---|---|---|---|---|---|
| | | Light | Moderate | Heavy | Very heavy | |
| | Number | Acres | | | | |
| Spokane I.R.: | | | | | | |
| Western pine beetle | 5 | 2,880 | 1,760 | 1,760 | 0 | 6,400 |
| Oregon pine ips | 4 | 360 | 0 | 80 | 0 | 440 |
| All insects | 9 | 3,240 | 1,760 | 1,840 | 0 | 6,840 |
| Glenwood District (W.S.D.N.R.): | | | | | | |
| Western pine beetle | 8 | 3,880 | 1,160 | 0 | 0 | 5,040 |
| Oregon pine ips | 1 | 160 | 0 | 0 | 0 | 160 |
| All insects | 9 | 4,040 | 1,160 | 0 | 0 | 5,200 |
| Southwest Washington (W.S.D.N.R.): | | | | | | |
| Balsam woolly aphid | 10 | 12,480 | 320 | 0 | 0 | 12,800 |

1/ All of Washington except Lincoln, Pend Oreille, Spokane, Whitman, and parts of Ferry and Stevens Counties.

2/ Mountain pine beetle damage has been separated by tree species attacked: L, lodgepole pine; W, western white pine.

3/ Administrative areas are abbreviated as follows: N.F., national forest; I.R., Indian reservation; N.P., national park; W.S.D.N.R., Washington State Department of Natural Resources.


DOMINION OF CANADA
VANCOUVER ISLAND
STRAIT OF JUAN DE FUCA
PACIFIC OCEAN
IDAHO
WASHINGTON
OREGON
CALIFORNIA
BELLINGHAM
SEATTLE
TACOMA
OLYMPIA
EVERETT
WENATCHEE
YAKIMA
SPOKANE
PORTLAND
SALEM
EUGENE
MEDFORD
PENDLETON
BAKER
PRINEVILLE
BEND
ROSEBURG
GRANTS PASS
LAKEVIEW
M T. B A K E R
MT. BAKER
MOUNT RAINIER
NAT'L PARK
OLYMPIC NAT'L PARK
YAKIMA INDIAN RESERVATION
WARM SPRINGS INDIAN RESERVATION
KLAMATH INDIAN RESERVATION
SPOKANE INDIAN RES.
COLVILLE INDIAN RES.
NESPELEM INDIAN RES.
UMATILLA INDIAN RES.
CRATER LAKE NAT'L PARK
OREGON CAVES NAT. MON.
ELLIOTT STATE FOREST
SILVER BU.
BALD RIDGE
LOOKOUT MTN.
JOHN DAY
ALDRICH MTN.
ANTELOPE MTN.
FRAZIER PT.
WOLF MTN.
WEST MYRTLE BU.
SNOW MTN.
KING MTN.
FLY CR.
DAIRY CR.
ROGGER PK.
KELLY CR.
PINE CR.
MOSS SPR.
SNAKE
JOSEPH
ENTERPRISE
ASOTIN
COLUMBIA
GARFIELD
WHITMAN
ADAMS
LINCOLN
GRANT
FRANKLIN
BENTON
KITTITAS
DOUGLAS
CHELAN
OKANOGAN
FERRY
STEVENS
PEND OREILLE
KALISPELL IND. RES.
WALLA WALLA
SAN JUAN
SKAGIT
SNOHOMISH
ISLAND
WHATCOM
CLALLAM
JEFFERSON
GRAYS HARBOR
PACIFIC
LEWIS
THURSTON
MASON
PIERCE
KING
KITSAP
WAHKIAKUM
CLATSOP
COLUMBIA
CLARK
SKAMANIA
KLICKITAT
TILLAMOOK
YAMHILL
POLK
MARION
LINN
BENTON
LINCOLN
DOUGLAS
COOS
CURRY
JOSEPHINE
JACKSON
KLAMATH
LAKE
DESCHUTES
CROOK
WHEELER
GILLIAM
MORROW
UMATILLA
GRANT
HARNEY
MALHEUR
BAKER
UNION
WALLOWA
WASCO
SHERMAN
HOOD RIVER
MULTNOMAH
CLACKAMAS
COLUMBIA RIVER
SNAKE RIVER
YAKIMA RIVER
COLUMBIA RIVER
WILLAMETTE RIVER
ROGUE RIVER
UMPQUA RIVER
KLAMATH RIVER
SMITH RIVER
CASCADE RANGE
BLUE MOUNTAINS
OLYMPIC MTS.
COAST RANGE
SIERRA NEVADA
FIGURE 2
SPRUCE BUDWORM SITUATION IN OREGON AND WASHINGTON
1958
Light Infestation 239,840 Acres
Moderate Infestation 59,200 Acres
Heavy Infestation 16,400 Acres
Aerial spraying project 1958 818,050 Acres
Aerial spraying project 1949-1955 3,839,611 Acres
FLY CREEK Control Unit Boundary and Name
Based on cooperative aerial and ground surveys
coordinated by
PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION
FOREST SERVICE U. S. DEPARTMENT OF AGRICULTURE
1959
Scale: 15 10 5 0 15 30 45 MILES


DOMINION OF CANADA
VANCOUVER ISLAND
PACIFIC OCEAN
IDAHO
CALIFORNIA
WASHINGTON
OREGON
Blaine
Bellingham
Port Angeles
Victoria
Seattle
Tacoma
Olympia
Everett
Wenatchee
Yakima
Spokane
Pullman
Walla Walla
Pendleton
Kennewick
Richland
Prosser
Ephrata
Ellensburg
Moses Lake
Omak
Okanogan
Colville
Republic
Chelan
Aberdeen
Hoquiam
Longview
Kelso
Vancouver
Portland
Astoria
Salem
Albany
Corvallis
Eugene
Roseburg
Medford
Grants Pass
Klamath Falls
Bend
Redmond
Prineville
The Dalles
Hood River
Pendleton
La Grande
Baker
Ontario
Nyssa
Burns
John Day
Lakeview
Crater Lake Natl. Park
Mount Rainier Natl. Park
Olympic Natl. Park
Yakima Indian Reservation
Warm Springs Indian Reservation
Klamath Indian Reservation
Umatilla Indian Reservation
Spokane Indian Reservation
Colville Indian Reservation
Nespelem Ind. Res.
Quinault Ind. Res.
Quileute Ind. Res.
Makah Ind. Res.
Lummi Ind. Res.
Nisqually Ind. Res.
Muckleshoot Ind. Res.
Port Madison Ind. Res.
Squaxin Ind. Res.
Shoalwater Ind. Res.
Kalispell Ind. Res.
Cascade Range
Columbia River
Snake River
Willamette River
Yakima River
Deschutes River
John Day River
Grande Ronde River
Rogue River
Umpqua River
Klamath River
Mount Baker
Glacier Peak
Mount Adams
Mount Hood
Mount Jefferson
Three Sisters
Mount Shasta
Crater Lake
Diamond Peak
Mount Thielsen
Mount Scott
Yamsay Mtn.
Mount McLoughlin
Upper Klamath Lake
Lower Klamath Lake
Klamath Falls
Tule Lake
Summer Lake
Silver Lake
Fort Rock
Paulina Peak
Newberry Crater
Pine Mtn.
China Hat
Grizzly Mtn.
Ochoco Mtns.
Blue Mtns.
Wallowa Mtns.
Elkhorn Mtns.
Strawberry Mtns.
Aneroid Mtn.
Sawtooth Mtn.
Steens Mtn.
Abert Lake
Goose Lake
Warner Lakes
Lake Chelan
Lake Roosevelt
Lake Wallula
Lake Umatilla
Lake Celilo
Lake Billy Chinook
Lake Owyhee
Lake Wenatchee
Lake Cle Elum
Lake Kachess
Lake Keechelus
Lake Easton
Lake Kalispell
Lake Pend Oreille
Lake Coeur d'Alene
Lake Chatcolet
Lake Waha
Lake Wallowa
Lake Abert
Lake Albert
Lake Merrill
Lake Ewauna
Lake Lenore
Lake Creek
Lake Creek
Lake Creek